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Wargaming and Analysis

Presentation for MORS Special Meeting

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A handwritten signature in black ink, reading "Ralph W. Passarelli". The signature is fluid and cursive, with the first name "Ralph" and last name "Passarelli" clearly legible, and "W." as a small initial in the middle.

Dr. Ralph W. Passarelli
Director, Theater Operations Team
Operations Evaluation Group

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Wargaming and analysis

MORS special meeting

Peter P. Perla

15 October 2007

You may notice that the title of my musings here today is the same as the title of this entire special meeting. As anyone who knows me can tell you, I am quite shy about expressing my beliefs in public. Nevertheless, I will force myself to describe some ideas about this subject that I have had for a long time, as well as propose some new thoughts that I have just started to kick around. I am probably more interested in what you folks have to say about these ideas than you are in what I have to say.

Wargaming



- **Bad definition:** Any type of modeling, including exercises, campaign analysis, computer simulation without players (CSWP)
- **My definition**
A warfare model or simulation that does not involve the operations of actual forces, and in which the flow of events shapes and is shaped by decisions made by a human player or players

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Our starting point, of course, has to be wargaming itself. What is it? Too often, people in this business use the term loosely, to describe everything from the activity of thousands of real troops and vehicles maneuvering across hundreds of square miles, to the largely intellectual activity of a couple of guys crouched over a paper map and pushing around tiny cardboard squares. What I am going to be talking about here are REAL wargames, not field exercises, analytical models, or computer simulations without players (what I call cazwhips). Real wargames involve human beings making decisions and dealing with the consequences of those decisions, but not the action of actual forces.

Elements of a wargame



- Objectives
- Scenario
- Database
- Models
- Rules
- Players
- (And analysts!)

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Long ago, I characterized the key elements necessary to make a wargame work in this way. They should be pretty self-explanatory. Note, however, that I like to think of the objectives as part of the game itself, not something tacked on as an afterthought, or something articulated at the beginning of the process and promptly forgotten or ignored as we get down to the business of building the real game.

Dimensions of game design



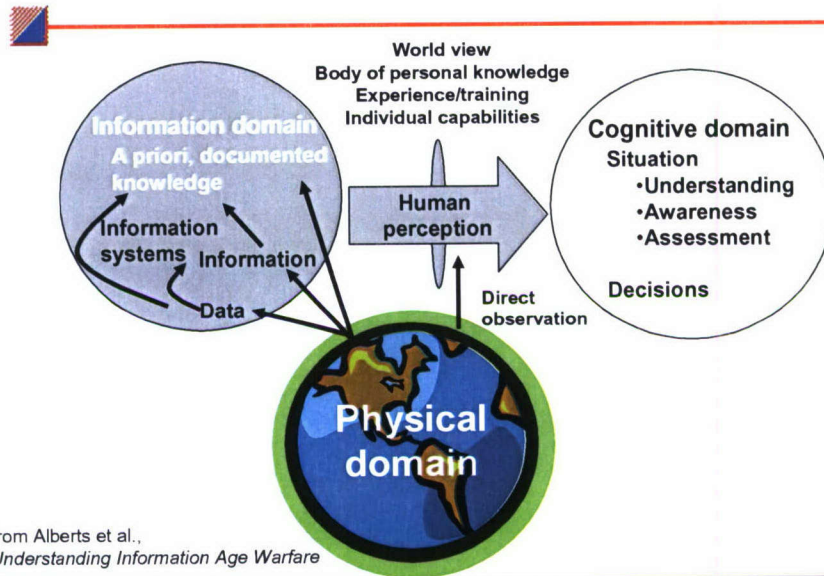
- **Time**
- **Space**
- **Entities**
- **Relationships**
- **Activities**
- **Dynamics**

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In practical terms, when we design one of these things we call a wargame, what do we do? Like any game, we basically create a synthetic or virtual universe in which our players will have to live. They'll observe situations, process information, and make decisions within the constraints we have defined in that universe. Their decisions and actions will change the universe as the game progresses. My colleagues at CNA—including Mike Markowitz, Ed McGrady, and Al Nofi—and I have tried to characterize the key dimensions of this wargaming universe a couple of times now. My current thinking has led to these six main components. By the way, they can be arranged to form the acronym TREADS, a term that fits the manly image of wargamer as tank-lover. But I kind of like the pairings on this slide: time and space; entities and relationships; activities and dynamics. In particular, I use “activities” to describe what the players do in the game, and “dynamics” to mean the changes their actions instigate in the game universe.

Now, what about war? How can we articulate a framework for defining the characteristics of real war so that we can help our games to represent it better?

Domains of real war



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This is one admittedly simplified way of characterizing war. I've cribbed this structure from one of the pubs from the Command and Control Research Program. Back in 2001, Dave Alberts and some of the analysts who support him published a book titled *Understanding Information Age Warfare*. This book proposed a construct that defined real war in terms of three domains: physical, informational, and cognitive. These domains represent, respectively, actual objective, physical reality; the ways that we can sense, analyze and report about that physical reality; and the ways that participants in a conflict perceive the physical reality in their own minds, as communicated to them by sensing and understood by them through analysis.

Design: three approaches



- *The Analyst* focuses on modeling the real world, including the players as elements of the model.
- *The Artist* focuses on immersing players in a story that they become part of, engaging them intellectually and emotionally.
- *The Architect* focuses on distilling a simplified decisionmaking environment to challenge players with key decisions.

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So, how do we go about translating our understanding and point of view about the real world of warfare into a game that will allow us to achieve whatever objectives we may have?

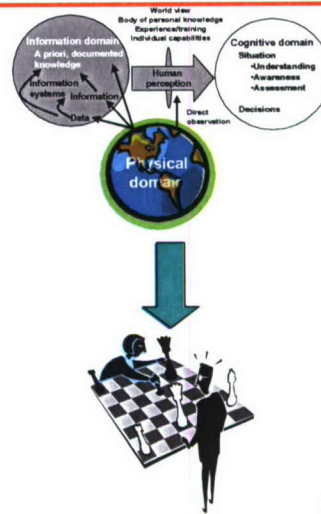
We have identified three distinct approaches to wargame design. Most actual designs incorporate elements of all three approaches. The first of these approaches we call the Analyst. It is very similar to other techniques of modeling and simulation in the defense community. For this reason, it tends to dominate the view of most defense professionals when we talk about wargaming. It is important to remember, however, that the Analyst approach is only one way to design wargames, and may not be the most appropriate approach for our current conditions.

Wargame design—*The Analyst*



The Analyst designs wargames to simulate real domains in the game's context using analytical models

Judged by "*Realism*"—how well game *models* reflect real-world effects, presuming that player *decisions* will somehow reflect *decisions* real-world commanders might take



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In the Analyst's approach to game design, the model, not the play, is the thing to catch the conscience of the king. The Analyst designs games in much the same way any analyst would design a warfare model or simulation. The goal of the game is to produce a realistic model of the situation it represents, and the measure of that realism is how well the relationships that the players have with the game's design elements reflect the relationships that real-world commanders have with the real domains that those design elements represent.

Current state of play



The Analyst approach
dominates DoD modeling,
simulation, and gaming

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Not surprisingly, perhaps, this is the dominant philosophy at the foundation of most DoD modeling, simulation, and gaming—at least as far as I have been able to see it. But let's explore the connection between analysis and gaming a bit further.

Definition: analysis



- Analysis is
 - A scientific method of providing decision makers with a quantitative basis for decisions
- Key words
 - Scientific
 - Quantitative

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I defined wargaming for you earlier. Here is my definition of analysis in our context. Actually, it is a definition drawn from one of the foundation documents of analysis, Morse and Kimball's *Methods of Operations Research*. You can see that the key words in this definition are the Gemini twins, "scientific and quantitative."

Wargaming is NOT analysis



- Key words for analysis
 - Scientific
 - Quantitative
- *Key words for wargaming*
 - *Decisions*
 - *Players*

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So, from my perspective, wargaming is not really analysis in the classic sense. Wargaming is about players and decisions, not about science and mathematics.

... and players are people



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This picture shows a team playing InfoChess. I was on the opposing team, led by John Warden of Desert Storm fame. We played these guys at a Connections Conference way too many years ago. We beat them in three or four moves, mainly because John played the players, as well as the game. He knew that at least one of these guys was a serious, rated, chess player and expected that he would approach the situation from a chess player's perspective. John realized that such an approach would be in serious trouble against an unconventional, asymmetric attack. He was right. The game was probably a better representation of the cognitive aspects of asymmetric warfare than any big-time simulation that today's community is trying to crank out. It was a simulation of the mental states of the key decisionmakers—much more important than the technical specifications of the AK-47.

Wargaming is not . . .



- Real
- Duplicable
- Universally applicable

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Wargaming is not analysis.

Nor is wargaming real. Sounds obvious, but I am continually surprised at how professionals can allow themselves to remember this fact when a game does not support their political position, but conveniently forget it when the game does seem to support them. The danger is especially real when the game is a good one and the victim of the illusion has little or no experience of real warfare.

Games can be good experimental testbeds, but they are not like Monte Carlo experiments. You cannot iterate a wargame changing only the random numbers. The players will never be identical, even if they are the same persons. Once you have played the game, you have learned and experienced something that changes your “state of nature,” if you will.

As a result, wargames are not universally applicable tools to solve all problems. Wargames are exercises in human behavior, human interaction, and human decisionmaking. The interplay of those human decisions and actions and the myriad ways they may change the game universe makes it impossible for two games to be the same. Wargames are best used to explore the role and potential effects of human behavior and human decisions. Other tools, such as analysis, are better tuned to deal with the more technical aspects of reality.

But it may be our best hope

- . . . to prepare for “Black Swans”
- Before they bite us!

THE BLACK SWAN



The Impact of the
HIGHLY IMPROBABLE

Nassim Nicholas Taleb

In spite of, or perhaps because of, these characteristics, wargames may be our one best hope of looking long enough and deeply enough into the uncertain future to help us prepare to encounter the Black Swans waiting for us there—before they bite us in the fundament!

Black Swan



- Highly improbable event that is:
 - Unpredictable
 - Carries massive impact
 - Something we tell ourselves stories about after the fact so that we can convince ourselves it was less random and more predictable than it really was
- Surviving—much less profiting from—them requires preparation, not prediction

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Some of you may have heard of or read the book *The Black Swan*. I won't try to give you more than a small glimpse of this oddly fascinating book. Suffice it to say that its author is a philosopher and Wall Street quant, a fallen statistician and a successful trader. A Black Swan, as he describes it, is a highly improbable event that has the three characteristics listed in the slide. The term arises because of the historical fact that for centuries, Europeans believed that, by definition, a swan was white—for the very simple reason that no one (of them anyway) had ever seen a black swan until explorers discovered them in Australia. The black swan demonstrated the danger of one of the human race's major intellectual flaws—we are too ready to believe that absence of evidence is the same as evidence of absence. Not so much.

The problem is, of course, that if you could predict a black swan, it would no longer be a black swan. So, if we cannot predict them, we must prepare for them, not by being ready to deal with specifics, but by being ready to respond to the unexpected. And the best way to train your mind to handle such unexpected situations is to practice dealing with other unexpected situations.

If you think that is a bit murky, try reading the book! But let's push on.

Examples of Black Swans



- A *real* black swan
- Fall of France, 1940
- 9/11 attacks
- Explosive success of Google
- Tsunami
- Global warming
- Iraq insurgency?

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Here are some examples of what I would consider Black Swans. Is the current insurgency in Iraq one? Not sure. The fact that it happened did not surprise many of us wargamers. Its detailed nature, however, is not something that I can claim to have foreseen. How about you?

The trick is . . .



- Know what you know
- Know what you don't know
- Learn what you don't know you know
- Learn what you don't know you don't know
- *This is where wargames will help!*

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But as Taleb, *The Black Swan*'s author, discusses, in order to deal with potential black swans you have to be able to assess your state of knowledge without delusion. To start with, you have to be sure of what you know and what you don't know. That's hard enough. Even more importantly—and more difficult—you need to learn what you don't know you know. Finally, you have to try to discover what you don't know you don't know. It was this discussion, more than any other, I think, that convinced me that Taleb was a deep thinker. Because nearly 20 years ago I had written that wargames were the way to learn what we don't know we don't know. Clearly, the man is brilliant.

Beyond simulation



- Simulations and “simulation games”
 - The forte of the Analyst-designer
 - Assume we know more than we do about warfare
- Two alternative design approaches free wargamers from analytical leg-irons: *the Artist* and *the Architect*

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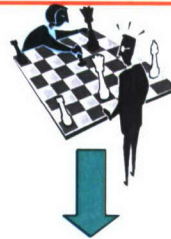
To do that, however—to use games to learn what we don’t know we know and what we don’t know we don’t know—we need to move beyond traditional simulations. The kinds of “simulation games” that are the forte of the Analyst game designer do their best to model the future by modeling the past. They too often leave little room for the unpredictable because so much of what happens must already reside in the underlying models.

The other two design approaches I described earlier, those of the Artist and the Architect, may help us go beyond those limitations.

Wargame design—*The Artist*



The Artist designs wargames to stimulate players to experience the story of the game from the Artist's point of view



Judged by *engagement*—how well player's *emotions* are stimulated to reflect how they would feel in a real situation



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The Artist uses detailed facts about the environment and effects of actions as the basis for constructing his world, and lets the players connect to and create from those facts freely. But he also grounds their activities in a context he himself creates to reflect his own perspective on (or point of view about) reality. Playing such a game demands more time than playing other types of games, and creates more “engagement.” The dynamics of the game itself emphasize its effects on the players—particularly on their emotions. It is less concerned with creating an objectively “realistic” experience, whose outcome—in terms of what actually happened in the game—may persuade an external “audience” to believe that the game says something “valid” about the real world.

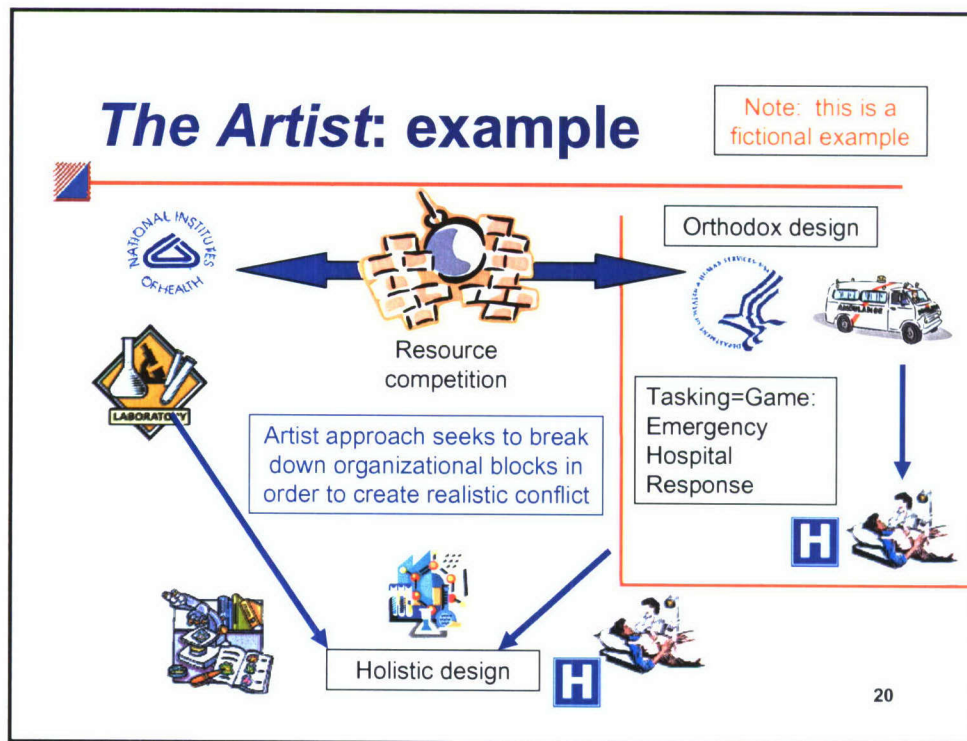
The Artist



- Focuses on human and organizational relationships
- Seeks to stimulate thought about conflicts within the player teams, as well as between them
- Designer “Point of View” based on organizational analysis of the *issues* the players need to work through

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Typically, at least in the realizations of this approach that I have seen and been involved in—most of them designed by my colleague, Ed McGrady—the game is really about human relationships, either interpersonal relationships or organizationally based relationships. The design of the game tries to play on the tensions that exist between the players in order to bring out the real and potential conflicts that might exist—not only between players or teams competing against each other, but also within those individuals and teams. The point of view that the designer uses as the core of the game must be based on a careful organizational analysis of the issues that players need to work through.



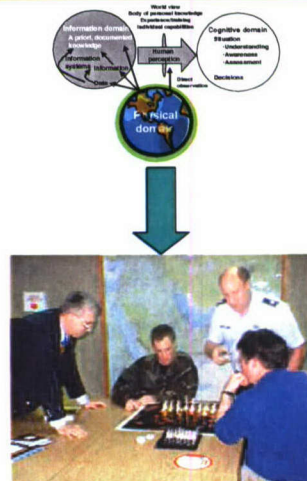
Let's consider a fictional example. Suppose we are tasked to design a game to practice an organization's emergency response procedures. The orthodox simulation-style approach to the task might focus on the obvious problem—in this case, procedures for doing emergency response—without taking into account how organizational relationships might affect the problem. While researching the situation, the Artist discovers that some response plans call for pulling scientists away from their normal research to support the emergency response group. The group responsible for conducting that research would experience significant disruption to its operations if its people were pulled away. To protect themselves from this problem, the research group has established formal and informal rules and policies to limit such cross tasking. These policies might seriously impede emergency response operations. So the Artist designs the game to break down the organizational barriers separating the two groups by placing representatives of both groups in the position of having to coordinate their sharing of personnel. Such a design would show the research branch the serious consequences of its not cooperating with the emergency response branch; it would also show the emergency response branch the disruptions caused by unnecessary or excessive requests for support. This type of design drives the scenario away from a simple "emergency response" game to one that simulates the activities of both the research and response groups, so that each shows the other why its positions are important. The more mechanistic approaches to game design sometimes do not reflect on the fact that internal organizational conflicts and limitations may exist for reasons that are valid if you take a perspective other than the one that seems the most obvious starting point for the design. A good Artist-designer looks at the problem from different perspectives and attempts to develop a design that will allow the participants to identify and work in a cooperative solution space.

Wargame design—*The Architect*



The Architect designs wargames to distill the real world into a tighter story focused on player *decisions*

Judged by *focus*—how well player *decision points* reflect choices and alternatives real-world decision-makers might face



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The Architect, on the other hand, tries to distill the details of the real world into a form that is more readily accessible to the players for making decisions—the decisions that the designer foresees (or fore-ordains) as being critical to the players as they live out the story of the game. The dynamics of the game center around those decision points, and analyzing the game depends on understanding why the players make the decisions they do, in the context of the real-world situation represented in the game. Playing a game of this type typically requires less time and less intellectual and emotional engagement than playing an Artist game based on similar subject matter, but it does so at the potentially high cost of reducing the ability of the players to range freely in their actions.

The Architect



- Focuses on organizational and institutional processes, and on key decisions players must confront
- Distills the results of analysis into those key decision points
- Designer “Point of View” embodied in the representation of the *environment* players must live in, not specific issues they must address

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Typically, at least in the games I have designed, the guts of an Architect's games are less explicitly about human relationships, and more explicitly about human decisionmaking processes. The design of the game tries to distill organizational and institutional processes into a relatively small number of critical decision points. The designer's point of view lies primarily in the choices he makes about how to represent the physical and decisionmaking environment the players must live in and act upon. Specific issues that the players must deal with should arise almost organically from their decision processes, and are less often specifically built into the game design than they are in the Artist's approach.

The Architect: example

Holding Box: Saudi Arabia

U.S. Pieces: [Empty Box] AQAM Pieces: [Empty Box]

Target sets: Far Enemy, Near Enemy, Umma

P	M	E	S	Infr	Info
-3	-3	-3	-3	-3	-3
-2	-2	-2	-2	-2	-2
-1	-1	-1	-1	-1	-1
0	0	0	0	0	0
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3

Al Qaeda resources

- Mullahs
- Money
- Mujahedin

U.S. resources

- Diplomatic
- Informational
- Military
- Economic

Action Cards

Action: Military
 Check for Military Action in any space containing at least one Mujahedin piece.

Event (S-rating)
 Popular religious reform movement: Select one space and adjust the S-rating by +1.

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For example, in a relatively uncomplicated game of the GWOT versus the Global Salafi Jihad of Al Qaeda, we contrasted an American institutional mindset hypnotized by DIME and PMESII and a jihadist “fantasy ideology.” We focused the game on basic decisions about resource allocation and strategic choices about which of a range of possible approaches the players would take to achieve their objectives while opposing those of their opponent. We used wooden blocks and poker chips to represent the major resources available to the players. We used specially designed “Action” cards to give them opportunities to use those resources, as well as to impose limitations on what they could do with them. As they play the game, the players have to confront the range of strategic alternatives naturally, as they decide where and to what end they should commit their limited resources. The design of the game universe regularizes their decision processes and focuses on key issues that we chose to emphasize. It does not, however, free the players to dream up new resources and new types of actions. This is the price an Architect-designer pays for increasing the speed and ease of play.



Mediocristan vs. Extremistan

- Analysis lives and works in the relatively stable, day-to-day world of “Mediocristan”
 - “The Sun’ll come up, Tomorrow!”
 - Gaussian errors bound the degree of uncertainty we are willing to admit to
- Wargaming should explore “Extremistan”
 - “Here lieth Black Swans!”
 - Admit and help prepare for “scalable” errors (low-probability, high-impact events)
- We need to use both for what they are best at

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Let us return once again to the world of the Black Swan. One of Taleb’s memorable metaphors in *The Black Swan* is his concept of the two lands of Mediocristan and Extremistan. In Mediocristan, no single observation is going to have a significant effect on the total value of a large sample. For example, if we averaged the heights of everyone in this room and Shaquille O’Neal walked in and we redid the calculation, the mean would not be much different. We are in Mediocristan. On the other hand, if we averaged the yearly income of everyone in the room and then added Bill Gates to the sample, the average would explode. That is Extremistan. In much of what we do, and nearly all of what we are willing to admit to, we behave more frequently as if we live in Mediocristan than in Extremistan. Here, most basic statistical techniques and our habitual use of Gaussian errors tend to hold us in good stead. Things go south in a hurry, however, when we find ourselves lost in the wilds of Extremistan with no better tools for confronting the dangers of the deadly Black Swan. It is the notion of the “scalability” of so much of real life, of fat tails and of massively extreme events with not-infinitesimal probabilities, that makes Extremistan so worrisome. Taleb argues that we need to refocus our efforts on dealing better with this world of Black Swans. I think it’s pretty clear that he’s right, but we should not respond by throwing out the familiar tools that work just fine, thank you, as long as we are in Mediocristan. We need classic military OR to deal with those problems. If you want to go looking for potential Black Swans, or at least learn ways to prepare for them—rather than trying, in vain, to predict them— you really need to use wargaming.

